9. FEDERAL WATER QUALITY CRITERIA AND STATE WATER QUALITY STANDARDS

Factor 10 of the 10 factors used to determine no unreasonable degradation requires the assessment of Federal marine water quality criteria and applicable state water quality standards. This chapter evaluates compliance with the Federal water quality criteria at the edge of a 100-meter mixing zone. In addition, compliance with Florida, Alabama and Mississippi water quality standards has been analyzed.

9.1 Federal Water Quality Criteria

Federal water quality criteria are established as guidelines for protection of water quality and human health. Table 9-1 presents a list of Federal water quality criteria for priority pollutants found in drilling or production discharges.

Table 9-1. Federal Water Quality Criteria

Pollutant	Marine Acute Criterion (µg/l)	Marine Chronic Criterion (µg/l)	Human Health Criterion (µg/l)
Anthracene			110,000
Antimony			4,300
Arsenic	69	36	0.14
Benzene			71
Benzo(a)pyrene			0.031
Cadmium	42	9.3	
Chlorobenzene			21,000
Chromium (VI)	1100	50	
Copper	4.8	3.1	
Di-n-butylphthalate			12,000
2,4-Dimethylphenol			2,300
Ethylbenzene			29,000
Fluorene			14,000
Lead	210	8.1	
Manganese			100
Mercury	1.8	0.94	0.051
Nickel	74	8.2	4,600
Phenol			4,600,000
Selenium	290	71	11,000
Silver	1.9		
Thallium			6.3
Toluene			200,000
Zinc	90	81	

[a] Human health criteria for consumption of organisms only; risk factor of 10^{-6} for carcinogens.
Source: EPA, 1999.

9.2 Florida Water Quality Standards

Water quality standards for the surface waters of Florida are established by the Department of Environmental Regulation in the Official Compilation of Rules and Regulations of the State of Florida, Chapter 62-302 - Surface Water Quality Standards (effective 12/26/96). These standards are presented in Table 9-2 for use classes applicable to the Desoto Canyon receiving water.

Table 9-2. Florida Water Quality Standards

Parameter	Shellfish Propagation of Harvesting (Class II) and Recreation, Fish and Wildlife (Class III-Marine) [a] (µg/l)
Aluminum	1,500
Antimony	4,300
Arsenic (total)	50
Benzene	71.28
Beryllium	0.13 annual average
Biological Integrity [b]	not reduced <75% of natural background
BOD	DO shall not drop below depressed limit for class
Cadmium	9.3
Chlorides	not more than 10% above natural background
Chlorine (total residual)	10
Chromium (VI)	50
Copper	2.9
Detergents	500
Dissolved Oxygen	5,000 daily average
Fluorides	1,500
Iron	300
Lead	5.6
Manganese	100 [c]
Mercury	0.025
Nickel	8.3
Oil and Grease	none visible
dissolved or emulsified--	5,000
pH	natural background ± .2 unit; 6.5 min. - 8.5 max.
Phenol	300
Phenolic Compounds	1.0
Radioactive Substances --radium (226+228)--	5 pCi/l
gross alpha--	15 pCi/l
Selenium	71
Silver	0.05
Thallium	6.3
Turbidity	≤29 NTU above natural background
Zinc	86

[a] Shall be applied to all state waters except within the zones of mixing.
[b] According to the Shannon-Weaver diversity index of benthic macroinvertebrates.
[c] Standard applies only to Class II water use.

The antidegradation policy of the standards requires that new and existing sources be subject to the highest statutory and regulatory requirements under Sections 301(b) and 306 of the Clean Water Act. In addition, water quality and existing uses of the receiving water shall be maintained and violations of water quality standards shall not be allowed.

Minimum criteria apply to all surface waters of the state and require that all places shall at all times be free from discharges that, alone or in combination with other substances or in combination with other components of discharges, cause any of the following conditions.

- Settleable pollutants to form putrescent deposits or otherwise create a nuisance
- Floating debris, scum, oil, or other matter in such amounts as to form nuisances
- Color, odor, taste, turbidity, or other conditions in such degree as to create a nuisance
- Acute toxicity (defined as greater than 1/3 of the 96-hour LC50)
- Concentrations of pollutants that are carcinogenic, mutagenic, or teratogenic to human beings or to significant, locally occurring wildlife or aquatic species
- Serious danger to the public health, safety, or welfare.

These general criteria of surface water apply to all surface waters except within zones of mixing. A mixing zone is defined as the surface water surrounding the area of discharge "within which an opportunity for the mixture of wastes with receiving waters has been afforded." Effluent limitations can be set where the analytical detection limit for pollutants is higher than the limitation based on computation of concentration in the receiving water.

9.3 Alabama Water Quality Standards

The Alabama Water Quality Criteria Standards are set forth by the Alabama Environmental Management Commission at Title 22, Chapter 335-6-10.

Toxic pollutant standards applicable to state waters are presented in Table 9-3. Alabama water quality standards provide instruction for calculating human health criteria based on pollutant-specific reference doses, bioconcentration factors, and cancer potency factors. These values used for the calculations are presented in Table 9-4.

Table 9-3. Alabama Toxic Pollutant Standards

Pollutant	Marine Acute Criteria (µg/l)	Marine Chronic Criteria (µg/l)	Human Health Criteria (µg/l)
Antimony			933
Arsenic	69	36	
Benzene			155
Benzo(a)pyrene			0.0675
Cadmium	43	9.3	
Chromium (VI)	1,100	50	
Copper	2.9	2.9	
2,4-Dimethylphenol			498
Di-n-butylphthalate			2,622
Ethylbenzene			6,222
Lead	220	8.5	
Mercury	2.1	0.025	0.121
Nickel	75	8.3	933
Phenol			1,000,000
Selenium	300	71	
Silver	2.3		
Thallium			133
Toluene			43,614
Zinc	95	86	

[a] Non-carcinogenic pollutant criteria calculated as:
[Human body weight (70 kg) x RfD]/[Fish consumption rate (0.030 kg/day) x BCF] x 1,000 µg/mg
RfD = Reference dose (Values presented in Table 9-4).
BCF = Bioconcentration factor (Values presented in Table 9-4).

[b] Carcinogenic pollutant criteria calculated as: [Human body weight (70 kg) x Risk level (1 x 10^{-5})]/[CPF x Fish consumption rate (0.030 kg/day) x BCF] x 1,000 µg/mg
CPF = Cancer potency factor (Values presented in Table 9-4).

Source: Alabama Department of Environmental Management, Water Division - Water Quality Program

Table 9-4. Reference Doses, BCFs, and Cancer Potency Factors Used to Calculate Alabama Toxic Pollutant Standards

Pollutant	Reference Dose (RfD) [mg/(kg-day)]	Bioconcentration Factor (BCF) (l/kg)	Cancer Potency Factor (CPF) [kg/day)/mg]
Antimony	0.0004	1.0	
Benzene		5.2	0.029
Benzo(a)pyrene		30	11.53
Beryllium		19	4.3
Chromium (VI)	0.005	16	
2,4-Dimethylphenol	0.02	93.8	
Di-n-butylphthalate	0.1	89	
Ethylbenzene	0.1	37.5	
Mercury	0.0003	5,500	
Nickel	0.02	47	
Phenol	0.6	1.4	
Thallium	0.0373	119	
Toluene	0.2	10.7	

Source: Alabama Department of Environmental Management Water Division, Water Quality Program, May 30, 1997.

9.4 Mississippi Water Quality Standards

The Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters are set forth by the Mississippi Air & Water Pollution Control Commission as adopted March 22, 1990. The Mississippi water quality criteria general conditions require that the following be met in all waters of the state:

- In open ocean waters there shall be no oxygen demanding substances added which will depress the dissolved oxygen content below 5.0 mg/1.
- Although mixing zones are sometimes unavoidable they will not substitute waste treatment. Application of mixing zones shall be made on a case-by-case basis and shall only occur in cases involving large surface water bodies in which a long distance or large area is required for the wastewater to completely mix with the receiving water body.
- The location of the mixing zone shall not significantly alter the receiving water outside its established boundary. Adequate zones of passage for the migration and free movement of fish and other aquatic biota shall be maintained. Under no circumstances shall mixing zones overlap or cover tributaries, nursery locations, or other ecologically sensitive areas.

Minimal conditions that are applicable to all waters include the following.

- Waters shall be free from substances that will settle to form putrescent or otherwise objectionable sludge deposits.
- Waters shall be free from floating debris, oil, scum, and other floating materials in amounts sufficient to be unsightly or deleterious.
- Waters shall be free from substances producing color, odor, taste, total suspended solids, or other conditions in such a degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses. Specifically, the turbidity outside a 750-foot mixing zone shall not exceed the background turbidity at the time of the discharge by more than 50 NTU.
- Waters shall be free from substances in concentrations or combinations which are toxic or harmful to humans, animals, or aquatic life.
- Wastes shall receive effective treatment or control in accordance with Section 301, 306, and 307 of the Federal Clean Water Act or to a greater degree of treatment if needed to protect water uses.
- Dissolved oxygen concentrations shall be maintained at a daily average of not less than 5.0 mg/1 with an instantaneous minimum of not less than 4.0 mg/1 in estuaries.
- The normal pH of waters shall be 6.5 to 9.0 and shall not vary more than 1.0 unit.
- In coastal or estuarine waters, the maximum temperature rise above natural temperatures shall not exceed 4°F during the period October through May nor more than 1.5°F above natural for the months June through September.

Mississippi numerical standards are presented in Table 9-5.

Table 9-5. Mississippi Toxic Pollutant Standards

Pollutant	Marine Acute Criteria (µg/l)	Marine Chronic Criteria (µg/l)	Human Health Criteria (µg/l)
Arsenic	69	36	0.14
Cadmium	43	9.3	168
Chromium (III)			673,077
Chromium (VI)	1,100	50	3,365
Copper	2.9	2.9	1,000
Lead	140	5.6	
Mercury			0.153
Nickel	75	8.3	4,584
Phenol	300	58	300
Selenium	300	71	
Silver	2.3		
Zinc	95	86	5,000

Source: State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters, Adopted November 16, 1995. Mississippi Department of Environmental Quality.

9.5 Compliance with Federal Water Quality Criteria

9.5.1 *Water Based Drilling Fluids Discharges*

Federal water quality criteria are compared to effluent concentrations projected for the edge of a 100-m mixing zone to determine the ability of drilling fluid discharges to achieve sufficient mixing and occur at concentrations below criteria in the surrounding waters. Table 9-6 presents the results of calculating the minimum number of dilutions that will ensure that all criteria are met by drilling fluid discharges at 100 meters from the discharge point. The minimum number of dilutions to achieve sufficient mixing for drilling fluids is projected to be 118 (the number of dilutions required to meet the arsenic human health criterion). Compared to drilling fluids modeling results presented in Chapter 4, there appears to be significant probability that the criteria can be met by the edge of a 100-m mixing zone.

For comparison, the preferred option of the MMS EIS for this development and production project specifies a maximum 400 bbl/hr discharge rate; water depths for the proposed activity area range from approximately 30 m to 150 m. For the generalized drilling fluid modeling approach that had been performed for EPA Region 10, a 500 bbl/hr discharge in a water depth of 20 m resulted in a minimum projected dilution of 1,035; even at a 1,000 bbl/hr discharge rate the available dilution is 655 at a water depth of 20 m and 731 at a water depth of 40 m. For a 1,000 bbl/hr discharge in a 70-m water depth, the dilutions achieved at 100 meters is 1,721, 10-fold greater than the amount required to meet the most stringent Federal water quality criteria in the Desoto Canyon area.

Table 9-6. Comparison of Federal Water Quality Criteria to Projected Drilling Fluids Pollutant Concentrations at 100 Meters

Pollutant	Effluent Conc. [a] (mg/l)	Leach Factor [b]	Federal Criteria (µg/l)			Minimum Dilutions Required [c]
			Marine Acute	Marine Chronic	Human Health	
Antimony	2,592	11%			110,000	<1
Arsenic	3,228	0.51%	69	36	0.14	118
Cadmium	0.50	11%	42	9.3		6
Chromium	109	3.4%	1,100	50		74
Copper	8.50	0.63%	4.8	3.1		17
Lead	15.9	2.0%	210	8.1		39
Mercury	0.045	1.8%	1.8	0.94	0.051	16
Nickel	6.138	4.3%	74	8.2	4,600	32
Selenium	0.50	11%	290	71	11,000	<1
Silver	0.318	11%	1.9			18
Thallium	0.546	11%			6.3	10
Zinc	91.16	0.41%	90	81	69,000	5

[a] See Table 3-3.
[b] The leach factor for metals for which no value was available is assumed to be 11%, equal to the highest value reported (cadmium).
[c] Calculated for each pollutant as: [(Effluent conc. x 1000 µg/mg) x leach factor]/lowest criterion value.

For the project-specific modeling approach, the minimum available dilutions under the most conservative scenario modeled was 150, which although closer to the required minimum dilution still affords an excess dilution under the least probable set of operational and environmental conditions. The occurrence of non-compliance with Federal water quality criteria appears to be highly unlikely based on the results of either modeling approach. And although the project-specific modeling approach and results have yet to be reviewed and verified by EPA, the comparability of the results lends some re-assurance to the likelihood that the project-specific approach will be found to be technically sound.

9.5.2 *Synthetic Based Drilling Fluids Discharges*

Assessments of water quality impacts from the discharge of cuttings with adhered synthetic based fluids (SBF-cuttings) rely on modeling data presented in a study (Brandsma, 1996) of the post-discharge transport behavior of oil and solids from cuttings contaminated with oil-based fluids (OBF-cuttings). Due to the similar hydrophobic and physical properties between SBFs and OBFs, EPA assumes that above 5% retention, that dispersion behavior of SBF-cuttings is similar to that of OBF-cuttings when discharged following shale shaker only (i.e. baseline technology) treatment of cuttings. However, at controlled discharge levels reflecting best-available technology treatment the cuttings are expected to disperse similar to WBF-cuttings.

The analyses in this chapter are somewhat conservative due to the assumption that discharged pollutants immediately leach into the water column. In the water column, total organic pollutant discharge concentrations are assumed to represent the soluble concentration. Metals are assumed to leach immediately into the water column at pollutant-specific amounts determined for mean seawater pH (as derived in Avanti Corporation, 1993).

To evaluate the relative water quality impacts of the current industry practice and regulatory options, EPA estimates the water column concentration of pollutants present in SBF drilling discharges under regulatory discharge options and compares them to Federal water quality criteria/toxic values. This comparative analysis applies only to those pollutants found in SBF discharges, and for which EPA has published numeric criteria, as presented in Table 9-1. Note that there are no criteria for the synthetic-based fluid compounds themselves.

In order to determine the water column pollutant concentrations, EPA used data regarding the transport of discharged drill solids and corresponding oil concentration in the water column. The study was performed by Brandsma (1996) and the data are published in the E&P Forum Summary Report No. 2.61/202 (1996). Following is a description of the Brandsma (1996) study from that E&P report.

Brandsma modeled the discharge of nine treatments of cuttings obtained from a North Sea drilling platform to obtain: (1) a maximum deposition density (g/m^2) of cuttings and oil; (2) water column concentrations of suspended solids and oil; (3) the maximum thickness (cm) of cuttings deposited on the seabed; and (4) the seabed area (ha) that would achieve a 100 ppm oil content threshold in the upper 4 cm or 10 cm of the sediment.

The treatment technologies included: (1) no treatment (lab formulated control), (2) untreated cuttings from shale shakers, (3) centrifugation, (4) solvent extraction, (5) thermal treatment, and (6) water washing. The bulk densities of the cutting ranged from 1,830 g/l to 2,430 g/l; oil content for the six types of cuttings ranged from 0.02% (dry weight basis) to 19.6%.

The author simulated four sites in the North Sea: Southern (30 m water depth and depth-averaged, root mean-squared current speed of 0.37 m/s); Central (100 m water depth and current speed of 0.26 m/s); Northern (150 m water depth and current speed of 0.22 m/s); and Haltenbanken (250 m water depth and current speed of 0.10 m/s).

The Offshore Operators Committee (OOC) drilling and production discharge model was used to simulate the concentrations and deposition of discharged cuttings. The OOC model utilized a mixture of 12 profile size classes of mud and cuttings particles (with adsorbed oil) and water. All other discharge conditions were fixed. All discharges simulated a 68.5-hour discharge of 152 m^3 of cuttings from a 0.3 m diameter pipe shunted to a depth of 15.2 m below mean sea level. This cuttings volume is the volume expected from a single well section of OBF-cuttings. Results presented are based on these 152 m^3 model efforts, however, results are scaled up to a 300 m^3 volume which was later determined by the project steering committee to be more representative of actual OBF-cuttings volumes generated using OBFs (representing two well sections).

Hydrographic conditions were conservatively selected to maximize predicted cuttings deposition on the seabed by choosing the minimum water column stratification at each site. The result is no density gradient at all sites but the Haltenbanken site which exhibited only a weak (0.0016 $kg/m^3/m$) gradient.

Water column results were determined at a radial distance of 1000 m downstream. For untreated and centrifuged OBF-cuttings, projected water column oil concentrations at 1000 m were below maximum North Sea background levels at all four sites; all other treatments resulted in projected

1000 m oil concentrations that exceeded maximum background levels (except through treatment at the Haltenbanken site). The explanation for this phenomenon is that while treatments other than centrifugation also reduce oil content (from an untreated level of 15.8% [w/w] to a range of 0.3% to 5.1%), these treatments also generate cuttings with finer particle sizes. Thus, according to the model, the untreated and centrifuged OBF-cuttings would not reach the 1000 m mark to the same extent that the treated OBF-cuttings would because the finer particles created by the treatment have lower settling velocities and are transported farther in the water column (Brandsma, 1996).

Although Brandsma (1996) does not present oil concentration data for a radial distance of 100 m (the edge of the mixing zone established for U.S. offshore discharges by Clean Water Act Section 403, Ocean Discharge Criteria, as codified at 40 CFR 125 Subpart M), the study does present data on suspended solids and oil concentration as a function of transport time. Using current speeds representative of each geographic area (Gulf of Mexico; Cook Inlet, Alaska; and offshore California) and the transport times reported by Brandsma, EPA derived the corresponding oil concentrations and dilutions at 100 m. For example, assuming a mean current speed of 15 cm/s as representative of the Gulf of Mexico, a transport time of approximately 11 minutes is derived as the time required for the plume to reach 100 m (100 m/0.15 m/sec). Using data obtained from Brandsma's 1996 study, EPA conducted a regression analysis to determine the oil concentration at selected transport times. Based on the mean initial oil concentration of the 9 cuttings cases presented in the study (5.5% in water-washed cuttings), the dilutions achieved can be estimated for a selected time (i.e., distance) in the following manner. The 5.5% (w/w) oil content converts to 55 g oil/kg wet cuttings. Based on a reported mean OBF-cuttings density of 2.050 kg wet cuttings/l, the initial oil concentration of 112,750 mg oil/l (55 g/kg x 2.050 kg/l) is used to determine the dilutions achieved. For the Gulf of Mexico example, the oil concentration at 11 minutes of 3.0 mg/l is used to calculate a 37,425-fold dilution (112,750 mg/3.0127 mg) at 11 minutes (Bowler, 1999). As described above, 11 minutes represents the estimated time at which the plume would reach the edge of the mixing zone at 100 meters.

Projected water column pollutant concentrations at the edge of a 100-m mixing zone are calculated by dividing the drilling waste pollutant concentration by the dilutions available. The effluent concentrations for metals are further adjusted by a leach factor to account for the portion of the total metal pollutant concentration that is dissolved and therefore available in the water column. In terms of metal concentrations, this analysis is conservative in that it assumes that all leachable metals are immediately leached into the water column.

When comparing the Federal water quality criteria to the SBF concentration in the water column at 100 meters from the discharge, no exceedances of any of the Federal water quality criteria occurred for any model wells in the Gulf of Mexico using the current technology, nor under either the discharge or zero discharge options.

9.6 Compliance with State Water Quality Standards

9.6.1 *Water Based Drilling Fluids Discharges*

Tables 9-7 and 9-8 respectively summarize the state water quality standards and the minimum dilutions required for drilling fluid discharges to achieve them for Florida and Alabama. State standards for Florida and Alabama are the same for 7 of 12 common pollutants (Cd, Cr, Cu, Hg, Ni, Se, and Zn). Alabama standards for antimony and arsenic (933 and 36 mg/l, respectively) are more stringent than Florida; Florida's standards for lead, silver, and thallium are more stringent than Alabama's standards. Florida also lists three pollutants that are not listed in Alabama - aluminum, beryllium, and iron. From the tables, it is readily apparent that, based on comparisons of dispersion/dilution projections and the required dispersions/dilutions listed in these tables, complying with all Alabama standards is highly likely.

In contrast, the minimum dispersions/dilutions required to meet Florida standards are greater than the minimum available dispersions/dilutions projected by either the generalized modeling approach or the project-specific approach in certain areas. Beryllium and aluminum, respectively, require 269 and 302 dispersions/dilutions; silver requires 700 and iron requires 2,558 dispersions/dilutions to meet state standards.

Table 9-7. Comparison of Florida State Water Quality Standards to Projected Drilling Fluids Pollutant Concentrations at 100 Meters

Pollutant	Effluent Conc.[a] (mg/l)	Florida Standard (µg/l)	Minimum Dilutions Required
Aluminum	4,124	1,500	302
Antimony	2,592	4,300	>1
Arsenic	3,228	50	>1
Beryllium	0.318	0.13	269
Cadmium	0.50	9.3	6
Chromium	109	50	74
Copper	8.50	2.9	18
Iron	6,976	300	2,558
Lead	15.9	5.6	57
Mercury	0.045	0.025	32
Nickel	6.138	8.3	32
Selenium	0.50	71	1
Silver	0.318	0.05	700
Thallium	0.546	6.3	10
Zinc	91.16	86	4

[a] See Table 3-3.

Table 9-8. Comparison of Alabama Water Quality Standards to Projected Drilling Fluids Pollutant Concentrations at 100 Meters

Pollutant	Effluent Conc.[a] (mg/l)	Alabama Standards (µg/l)			Minimum Dilutions Required
		Marine Acute	Marine Chronic	Human Health	
Antimony	2,592			933	<1
Arsenic	3,228	69	36		<1
Cadmium	0.50	43	9.3		6
Chromium	109	1,100	50		74
Copper	8.50	2.9	2.9		18
Lead	15.9	220	8.5		37
Mercury	0.045	2.1	0.025		32
Nickel	6.138	75	8.3		32
Selenium	0.50	300	71		<1
Silver	0.318	2.3			15
Thallium	0.546			133	<1
Zinc	91.16	95	86		4

[a] See Table 3-3.

Using the generalized modeling approach, the projected minimum available dispersions/dilutions required for all pollutants but iron are sufficient to comply with Florida standards at the edge of the 100-m mixing zone. Only in the case of iron, which requires 2,552 dispersions/dilutions to achieve the state standard, is there an issue with respect to compliance with state standards. The results of the project-specific analysis indicates that for worst case analyses, the dilutions available are not sufficient to comply with Florida's standards for four pollutants (Be, Al, Ag, and Fe). For modeling scenarios other than those for which the minimum dispersion/dilution is projected, again, only iron remains a potential issue.

Several factors mitigate the potential water quality non-compliance projected above. First, these non-compliance issues occur for worst case conditions, which requires a set of assumptions that are not likely to be encountered except rarely. Second, for iron, which is the pollutant with the largest exceedances, a surrogate leach factor is used (11%) based on the most mobile trace metal (Cd) because no leach data are available for iron. Related to this factor, iron is expected to have a low leach factor; it has low solubility in seawater due to its ability to form precipitates from several anions that are in abundance in seawater. Third, compliance with state standards is being assessed at the edge of the 100-m mixing zone. While appropriate for discharges in state waters, this project is located some 16 miles from the state waters of Florida. It is expected that no state water quality standards will be violated within the territorial seas of the State of Florida.

In Mississippi, the projected maximum drilling fluid discharge rate would not cause any exceedances of the state water quality standards (Table 9- 8).

Table 9-9. Comparison of Mississippi Water Quality Standards to Projected Drilling Fluid Pollutant Concentrations at 100 meters (in µg/l)

Pollutant	Effluent Concentrations[a]	Extraction Factors[b]	Concentration at 100 meters			State Standard[e]		
			15 m water depth[c]	40m water depth[c]	70m water depth[c]	Marine Acute	Marine Chronic	Human Health
Arsenic	3,228	0.51%	0.029	0.021	0.010	69	36	0.14
Cadmium	500	11 %	0.098	0.070	0.032	43	9.3	168
Chromium VI	109,116	3.4%	6.60	4.714	2.156	1,100	50	3,365
Copper	8,502	0.63%	0.095	0.068	0.031	2.9	2.9	1,000
Lead	15,958	2.0%	0.568	0.406	0.185	140	5.6	
Mercury	45	1.8 %	0.001	0.001	0.0005			0.153
Nickel	6,138	4.3 %	0.470	0.335	0.153	75	8.3	4,584
Selenium	500	100 %	0.890	0.635	0.290	300	71	
Silver	318	100%	0.566	0.404	0.185	2.3		
Zinc	91,157	0.41 %	0.665	0.475	0.217	95	86	5,000

[a]See Table 3-3.
[b]The extraction factors represent the trace metal leach percentages from barite and drilling fluids.
[c]The average OOC Model run dilution results were used for each of the water depths (See Table 4-7). For 15m, dilution = 562, 40m = 787, and 70m = 1,721.
[d]See Table 9-5.
Source: Avanti, 1993.